

REMARKS

Claims 1-44 are pending, with claims 1, 14, 24, 32, 40, and 42 being independent. Claims 24, 27, 28, 32, 35, 36, 42, 43, and 44 have been cancelled by this amendment without prejudice. Claims 2, 3, 12, 18, 22, 25, 29, 30, 33, 37, 38, and 41 have been amended. New claims 45-49 have been added. No new matter has been added. Reconsideration and allowance of the above-referenced application are respectfully requested.

Objections to the Specification:

The title stands objected to as allegedly failing to be descriptive. This objection is respectfully traversed. The original title is in fact descriptive of the disclosed subject matter generally, and there is no requirement that the title directly correspond to the claims; the claims themselves define the invention, not the title. Nonetheless, the title has been amended to be more clearly indicative of the disclosed and claimed subject matter. Thus, withdrawal of the objection to the title is respectfully requested.

The Background and Summary sections stand objected to for allegedly failing to comply with the suggested application format as outlined in MPEP §§ 608.01(c) & 608.01(d). These objections are respectfully traversed. The present Background section includes a statement of the field of art to which the

invention pertains in paragraph [0003], and also includes a description of the related art in paragraph [0004]. The Summary section includes a general statement of the invention in paragraphs [0005]-[0007].

Additionally, the cited portions of the MPEP, and 37 CFR 1.73, make clear that the rule merely states what a specification should include, and falls short of making the described application format mandatory. Since compliance with Rule 73 is entirely voluntary, it is respectfully suggested that the application is totally complete as filed, and therefore the requirements for changes to the Background and Summary sections are respectfully traversed. Thus, withdrawal of the objections to the Background and Summary sections is respectfully requested.

The disclosure stands objected to for various informalities. The specification has been amended to correct these informalities. Thus, withdrawal of the objection to the disclosure is respectfully requested.

Claim Rejections under 35 U.S.C. 112:

Claims 1-44 stand rejected under 35 U.S.C. 112, first paragraph, as allegedly not being enabled with respect to "at least one image sensor". The office action asserts, "on pages 24-25, paragraphs [0064] and [0065], [the specification states]

that a stereo camera is necessary and this is illustrated in Fig. 2 for a mobile image sensor." This contention is respectfully traversed.

Paragraph [0064] states, "The system 200 can be a self-contained portable tracking package (e.g., a backpack) that includes a stereo camera 210." (Emphasis added.) Neither this portion of the specification, nor any other portion of the specification suggests a requirement that an image sensor being tracked in the environment be a stereo camera. Paragraphs [0032] and [0061] make very clear that only a single image sensor need be tracked in the environment. Furthermore, paragraph [0065] makes clear that even if a stereo camera is used, only one channel need be used for video projection. In addition, FIGS. 6, 8, and 10 clearly show that only a single projection frustum is used, for each of one or more tracked image sensors in the environment, in the image projection example being described. Therefore, one skilled in art would clearly understand from the specification that only a single image sensor need be tracked in the environment. Thus, withdrawal of the 35 U.S.C. 112, first paragraph, rejection of claims 1-44 is respectfully requested.

Claims 1-44 stand rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite. This contention is respectfully traversed. With respect to independent claims 1,

14, 24, 32, 40, and 42, the above remarks are equally applicable. In addition, it is noted that none of claims recite a "camera", as is suggested in the office action. These claims recite "at least one image sensor", of which a camera is but one example. One skilled in the art would clearly understand the subject matter being claimed in view of the specification. Thus, these claims are definite as written.

With respect to claims 28 and 36, the term "morphological" is definite in view of the knowledge of one skilled in the art. Nonetheless, the term "morphological" has been removed in the rewriting of claims 29 and 37 into independent form, and claims 28 and 36 have been cancelled without prejudice. Thus, this rejection of claims 28 and 36 has been obviated by the present amendment.

In view of the above, withdrawal of the 35 U.S.C. 112, second paragraph, rejection of claims 1-44 is respectfully requested.

Allowable Subject Matter:

Claims 12, 22, 29, and 37 have been indicated as allowable if rewritten in independent form, and if the rejection(s) under 35 U.S.C. 112, second paragraph, are overcome. Claims 12, 22, 29, and 37 have been rewritten in independent form. In view of

this amendment, and the remarks above, allowance of these claims is respectfully requested.

Claim Rejections under 35 U.S.C. 103:

Claims 1-2, 5, 7-9, 11, 14, 21, and 40 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar et al (US PGPub 2001/0038718 A1) in view of Haala et al (Generation of 3D City Models From Airborne Laser Scanning Data). Claims 3, 18, and 41 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar in view of Haala as applied to claim 2 above, and further in view of You et al (Automatic Object Modeling for 3D Virtual Environment). Claims 4, 10, 15-17, and 20 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar in view of Haala as applied to claim 2 above, and further in view of Arpa et al (US 2003/0085992 A1). Claims 6 and 19 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar in view of Haala as applied to claim 1 above, and further in view of Weinhouse et al (Texture Mapping 3D Models of Real-World Scenes). Claims 13 and 23 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar in view of Haala as applied to claim 1 above, and further in view of Pryor et al (US 2004/0046736 A1). These contentions are respectfully traversed.

Kumar describes the alignment of input images with reference images that are already aligned with data. (See Kumar at Abstract.) In Kumar, alignment is performed in several ways, including the use of a "projective transformation", which provides a mathematical relationship that describes the mapping from one two dimensional (2D) image to another. (See e.g., Kumar at paragraphs [0034], [0035], and [0037].) Kumar further makes use of the term "projection" as a mapping from three dimensional (3D) points (vertices of a 3D mesh) onto a 2D image plane for producing new reference images. (See e.g., Kumar at paragraph [0103].) In both cases the term "projection" is used, but does not describe the subject matter of the present claims.

Independent claims 1 and 40 recite, "projecting real-time video imagery information from the at least one image sensor onto the three dimensional model based on the tracked orientation information". Independent claim 40 recites, "a dynamic fusion imagery projection component that projects real-time video imagery information from at least one image sensor onto the three dimensional model based on orientation information of the at least one image sensor tracked in the environment with respect to the three dimensional model in real-time". In view of the specification, this claim language clearly indicates a mapping from 2D image data onto a set of 3D geometric surfaces that can be viewed from arbitrary viewpoints.

This is analogous to using a slide projector to project an image onto the walls and objects in a room. The process and effect of such a projection is entirely different than the single mapping or "projective transformation", which relates a 2D image to another 2D image, as described in Kumar. There is no reference in Kumar, under any terminology, to a process of image projection, as is presently claimed.

In addition, there is no motivation to combine the references. Kumar is not directed to generation of three dimensional terrain maps, as suggested in the official action. Rather, Kumar is directed to aligning 2D images from a sensor (e.g., dynamically generated video from an aerial platform) with reference imagery, and then overlaying data associated with the reference imagery on the 2D images. Each of independent claims 1, 14, and 40 require that "the at least one image sensor" is tracked "in the environment", which allows the claimed image projection onto the three dimensional model from the perspective of the image sensor. In contrast, Kumar teaches away from the proposed combination in that Kumar makes clear the "two-dimensional projective transform [...] is valid when there is only a small view-point difference between the rendered reference image and the video frame and the distance between camera to ground is large as compared to the height of objects in the scene." (See Kumar at paragraph [0084].) Thus, there is no

motivation to combine Kumar, Haala, and Arpa as proposed, and even if such combinations could be made, they would not result in the presently claimed subject matter.

Thus, independent claims 1, 14, and 40 should each be allowable. Dependent claims 4-11, 13, 15-17, 19-21, and 23 each depend from an allowable base claim for at least the reasons discussed above and should thus also be allowable.

In addition, claims 2, 18, and 41 have been amended to be in independent form and to recite additional aspects of the three dimensional model generation. Dependent claim 3 has been amended to recite additional aspects of the selection of geometric primitives and the parametric fitting, and new dependent claim 45 recites still further details. New dependent claims 46-49 recite similar subject matter as claims 3 and 45. Support for these amendments can be found in paragraphs [0038] to [0059] of the specification.

The claimed subject matter allows a user to define part of a building, rather than the whole structure at once. Users may select one primitive at a time to describe parts of an arbitrary structure, which allows the modeling approach to readily scale to arbitrary building complexity. This human-guided approach can result in better models than the completely automated method of Haala, but without requiring inordinate user input. As stated in the specification, "A person can assist in selecting

the group type and thus the associated primitives [...] and this scene segmentation and model fitting approach to building a 3D model of a large urban environment can enable rapid creation of models of large environments with minimal effort and low cost." (See specification at paragraphs [0058] and [0059].)

In addition, using the constrained best fitting of geometric primitives approach can result in improved 3D models that can be rapidly developed even if limited input data is available, such as might be the case in an urban, battlefield environment. The use of constrained 3D shapes, such as spheres and cuboids, allows rapid modeling of buildings even when the input data is less than ideal. As described in the specification, "once the buildings are detected and segmented, the predefined geometric primitives can be iteratively fitted to the data and the best fitting models can be used to represent the building structures. [...] Moreover, undersampled building details and occlusions from landscaping and overhangs can also be handled without resulting in data voids." (See specification at paragraphs [0058] and [0059].)

In contrast, Haala performs plane fitting, which makes it difficult to segment the edges of buildings. "Due to the very pretentious problem of automatic interpretation of height or range data, optimal results can only be achieved by using supplementary sources of information. Within the approach

presented in this paper the segmentation of planar surfaces from the DSM [Digital Surface Model], which is a prerequisite for the 3D reconstruction of the buildings, is supported by given ground plans." (See Haala at Abstract.) The presently claimed subject matter can solve the edge problem described in Haala without the need for 2D CAD (Computer Aided Design) or GIS (Geo Information System) data representing ground plans for the structures being modeled.

The art of record fails to teach or suggest the features now claimed. Thus, claims 2, 3, 18, 41, and 45-49 should be allowable.

Claims 24-28, 30-36, 38, and 42-44 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Kumar in view Arpa. Claims 31 and 39 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Arpa in view of Kumar as applied to claim 24 above, and further in view of Haala. These contentions are respectfully traversed.

Claims 24, 27, 28, 32, 35, 36, and 42-44 have been cancelled by this amendment without prejudice. The remaining claims 25, 26, 30, 31, 33, and 34 now depend from an allowable base claim. Thus, the rejections of claims 24-28, 30-36, 38, 39, and 42-44 have been obviated by the present amendment.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific issue

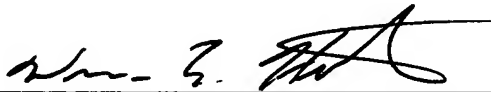
or comment does not signify agreement with or concession of that issue or comment. Because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

.It is respectfully suggested for all of these reasons, that the current rejections are overcome, that none of the cited art teaches or suggests the features which are claimed, and therefore that all of these claims should be in condition for allowance. A formal notice of allowance is thus respectfully requested.

Enclosed is a \$300 check for excess claim fees. Please apply any other necessary charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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